



PISCATAWAY TOWNSHIP SCHOOLS

Dr. Frank Ranelli

Superintendent of Schools

Dr. William Baskerville

Assistant Superintendent for
Curriculum and Instruction

Content Area: Human Anatomy and Physiology II
for Health Science Careers

Grade Span: 12

Revised by: Jessica Pritchard

Presented by: Jessica Pritchard

Approval date: August 2022

Members of the Board of Education

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Shantell Cherry – Vice President

Nancy Corradino

Ralph Johnson

Kimberly Lane

Calvin Laughlin

Sarah Rashid

Zoe Scotto

Brenda Smith

Piscataway Township Schools

1515 Stelton Road

Piscataway, NJ 08854-1332

732 572-2289, ext. 2561

Fax 732 572-1540

www.piscatawayschools.org

COURSE OVERVIEW

Description

Anatomy and Physiology II for Health Science Careers is a 5-credit course that has been developed in partnership with Rutgers School of Health Professions. This course incorporates Medical terminology as it pertains to body systems, anatomy, physiology, medical processes and procedures and a variety of diseases.

This course picks-up where Anatomy and Physiology I for Health Science Careers ends. It follows a sequential development of the major body systems in an organized and structured curriculum. The course is designed to give the students a selective overview of human anatomical structure and an analysis of human physiological principles. Medical terminology as it relates to the human body and health science careers is emphasized throughout. Labs will include slide work, dissection of various animals and studies of the human skeleton. The course will also use computer simulated dissections.

Upon completion of all requirements set forth by Rutgers University, students will be eligible to earn 4 College Credits for Anatomy II and 3 College credits for Medical Terminology from Rutgers University. Students must attain a passing grade on Rutgers standardized assessments for Anatomy I to be eligible for Rutgers credits for Anatomy II.

Goals

The overall goal for Human Anatomy and Physiology II for Health Science Careers is to provide a strong foundation of understanding of the human body for students interested in careers in the healthcare field and other courses in science at the college level. This course is also designed to give students a comprehensive knowledge of word construction, definition and use of terms related to all areas of medical sciences. It provides specialized language for the healthcare field, enabling healthcare workers to communicate in an accurate, articulate and concise manner.

Scope and Sequence

Unit	Topic	Length
1	Endocrine System	13 days
2	Digestive System & Respiratory System	16 days
3	Blood & Cardiovascular System & Lymphatic System	22 days
4	Urinary System & Fluid, Electrolyte, Acid Balance	13 days
5	Male & Female Reproductive System	13 days

UNIT 1: Endocrine System

Summary and Rationale	
<p>The physiology of hormonal action is described in detail as is the control of hormonal secretions. Students are introduced to the principal components of the endocrine system in terms of location, structure, hormones secreted, physiological effects, and disorders that result from abnormal secretion levels. Emphasis throughout is placed on the regulation of hormone secretions by negative feedback systems. The activities of endocrine tissues and its importance in the maintenance of homeostasis is emphasized within this chapter.</p>	
Recommended Pacing	
13 days	
State Standards	
<p>HS-LS1-1. Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life.</p>	
Assessment Boundary	Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.
<p>HS-LS1-2 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.</p>	
Clarification Statement	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
Assessment Boundary	Assessment does not include interactions and functions at the molecular or chemical reaction level.
<p>HS-LS1-3 Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.</p>	
Clarification Statement	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
Assessment Boundary	Assessment does not include the cellular processes involved in the feedback mechanism.
Instructional Focus	
Unit Enduring Understandings (Cross Cutting Concepts)	
<ul style="list-style-type: none"> ● Scientific investigation requires selection of suitable technology and use of appropriate methods based on intended purpose to collect, analyze, and interpret data to test prediction/hypotheses and diagnose disease. ● Organisms are composed of complex biochemical systems that are designed to maintain homeostasis. ● Survival of organisms is dependent on the relationship between structure and function. 	
Unit Essential Questions	
<ul style="list-style-type: none"> ● How do the components of the endocrine system work together? ● What disease, condition, or disorder can occur if the endocrine system is not working properly? 	
Objectives	
<p>Students will know & be able to:</p> <ul style="list-style-type: none"> ● On a diagram, identify all the glands and tissues that make up the endocrine system. ● Differentiate between endocrine and exocrine glands. ● Describe the major endocrine glands of the body and list the hormones they secrete. 	

- Differentiate between the anterior and posterior pituitary gland.
- Define the term hormone and describe the functions of hormones.
- Describe the functions of the hormones secreted by the endocrine glands.
- Describe the transportation process of hormones and their interaction with target cell receptors.
- Discuss how hormones promote homeostasis of the body and give three examples of hormonal actions.
- Describe negative feedback, how it regulates hormonal secretions and give two examples.
- Describe the functional relationship between the hypothalamus and the pituitary gland.
- Differentiate between physical and psychological stress.
- Describe the effects of aging on the endocrine system.
- List and describe disease/disorders associated with the endocrine system.
- Contrast the actions of insulin and glucagon.
- Define important terminology of the endocrine system.

UNIT 2: Digestive System & Respiratory System

Summary and Rationale	
<p>Because many food molecules are too large to enter the cells, the organs of the digestive system mechanically and chemically break them down to a size that can cross cell membranes. Specifically, the digestive system ingests foods, breaks large particles into smaller ones, secretes enzymes that decompose food molecules, absorbs the products, and eliminates unused residues. Nutrition includes the process that ingest, assimilate and utilize nutrients. Cells require oxygen to oxidize nutrients, release energy, produce ATP and excrete the carbon dioxide that results. Obtaining oxygen and removing carbon dioxide are the primary functions of the respiratory system. The respiratory organs also trap particles from incoming air, help control the temperature and water content of incoming air, produce vocal sounds and play an important roles in smell and regulation of blood pH.</p>	
Recommended Pacing	
16 days	
State Standards	
<p>HS-LS1-1. Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life.</p>	
Assessment Boundary	Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.
<p>HS-LS1-2 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.</p>	
Clarification Statement	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
Assessment Boundary	Assessment does not include interactions and functions at the molecular or chemical reaction level.
<p>HS-LS1-3 Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.</p>	
Clarification Statement	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
Assessment Boundary	Assessment does not include the cellular processes involved in the feedback mechanism.
<p>HS-LS1-7. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.</p>	
Clarification Statement	Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.
Assessment Boundary	Assessment should not include identification of the steps or specific processes involved in cellular respiration.
Instructional Focus	
Unit Enduring Understandings (Cross Cutting Concepts)	

- Scientific investigation requires selection of suitable technology and use of appropriate methods based on intended purpose to collect, analyze, and interpret data to test prediction/hypotheses and diagnose disease.
- Organisms are composed of complex biochemical systems that are designed to maintain homeostasis.
- Survival of organisms is dependent on the relationship between structure and function.

Unit Essential Questions

- How do the components of the digestive system work together?
- What disease, condition, or disorder can occur if the digestive system is not working properly?
- How do the components of the respiratory system work together?
- What disease, condition, or disorder can occur if the respiratory system is not working properly?

Objectives

Students will know & be able to:

- Name, describe and locate the structures and organs of the digestive system.
- Describe the functions of the digestive system and the liver.
- Describe the composition and functions of saliva.
- Describe the basic anatomy of the teeth and oral cavity and explain their functions in the digestive system.
- Describe the mechanism of swallowing, vomiting, and defecation.
- Describe the mechanism peristalsis and its role in the G.I. tract.
- List the enzymes secreted by the various digestive organs and describe the function of each.
- Explain how gastric secretions are regulated.
- List and describe the four layers of the wall of the G.I. tract.
- Describe the structure and function of the liver and gallbladder.
- Describe the pancreatic structure.
- List and explain the digestive function of the pancreatic secretions.
- Describe the structure and function of the small intestine.
- Describe the structure and function of the large intestine and the rectum.
- Explain how the processes in the stomach, liver, pancreas, gallbladder, and small intestines are coordinated.
- Describe the absorption of nutrients in the small intestine.
- Define enzyme, metabolism, anabolism, and catabolism.
- List in sequence each structure through which a bite of food passes on its way through the digestive system.
- List and describe diseases/disorders associated with the digestive system.
- Define important terminology of the digestive system.
- Describe the general functions of the respiratory system.
- List and describe the structure and organs of the respiratory system.
- Describe the functions of the structures and organs of the respiratory system.
- Describe the protective mechanisms in the respiratory system.
- Describe the events involved in inspiration and preparation.
- List and describe each of the respiratory air volumes.
- Outline the types of non-respiratory air movements and describe how each occurs.
- Explain how the respiratory muscles cause volume changes that lead to air flow into and out of the lungs.
- Describe the process of gas exchanges in the lungs and tissues.
- Explain how respiratory gasses are carried by the blood.
- Name the main areas involved in the control of respiration.
- List three factors that influence respiratory rate.
- Explain the major events that occur during cellular respiration.
- Explain how oxygen is used by cells.
- Trace the breath of air through the respiratory system from nose to alveoli.
- Describe the symptoms and probable causes of Chronic Obstructive Pulmonary Disease and lung cancer.
- Describe diseases/disorders associated with the respiratory system.
- Define important terminology related to the respiratory system.

UNIT 3: Blood & Cardiovascular System & Lymphatic System

Summary and Rationale

Blood supplies life and it has many vital functions. The complex mixture of cells and dissolved biochemical transports nutrients, oxygen, wastes, and hormones; helps maintain stability of the interstitial fluid and distributes heat. The blood, heart and blood vessels form the cardiovascular system and link the body's internal and external environments. The cardiovascular system, a powerful pump connected to an extensive system of tubes, brings oxygen and nutrients to all body cells and removes wastes. A functional cardiovascular system is vital for survival because without circulation tissues lack a supply of oxygen and nutrients. The lymphatic system transports fluid leaving the capillaries to the veins, which return the fluid to the circulation. Thereby preventing it from accumulating in tissue spaces. The lymphatic system also enables us to live in a world filled with different types of organisms some of which can take up residence in the human body and cause infections. The lymphatic system is a vast collection of cells and biochemicals that travel in lymphatic vessels and the organs and glands that produce them. It also recognizes and destroys foreign particles that include infectious microorganisms, viruses, toxins and cancer cells.

Recommended Pacing

22 days

State Standards

HS-LS1-1. Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life.

Assessment Boundary	Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.
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HS-LS1-2 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.

Clarification Statement	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
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Assessment Boundary	Assessment does not include interactions and functions at the molecular or chemical reaction level.
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HS-LS1-3 Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

Clarification Statement	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
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Assessment Boundary	Assessment does not include the cellular processes involved in the feedback mechanism.
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HS-LS1-4. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Assessment Boundary	Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.
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Instructional Focus

Unit Enduring Understandings (Cross Cutting Concepts)

- Scientific investigation requires selection of suitable technology and use of appropriate methods based on intended purpose to collect, analyze, and interpret data to test prediction/hypotheses and diagnose disease.
- Organisms are composed of complex biochemical systems that are designed to maintain homeostasis.
- Survival of organisms is dependent on the relationship between structure and function.

Unit Essential Questions

- What are the vital functions of blood tissue?
- How do the components of the cardiovascular system work together?
- What disease, condition, or disorder can occur if the cardiovascular system is not working properly?
- How do the components of the lymphatic system work together?
- What disease, condition, or disorder can occur if the lymphatic system is not working properly?

Objectives

Students will know & be able to:

- Describe the functions of the lymphatic system.
- Describe the composition of plasma and discuss its importance in the body.
- Distinguish between the formed elements found in the blood.
- Identify the stages involved in blood clotting and explain the various facets that promote and inhibit blood clotting.
- Explain the basis for blood typing.
- Describe how blood reactions may occur between the fetal and maternal tissues.
- Explain the basis of physiological jaundice seen in some newborn babies.
- List and describe disease/disorders associated with the blood.
- Define important terminology related to the blood.
- What are the structures of the cardiovascular system and describe their functions.
- What are the major parts of the heart and describe their functions.
- Describe the flow of blood through the heart.
- Describe the coronary circulation.
- Compare the structures and function of arteries, capillaries, and veins.
- What is the mechanism that helps in the return of venous blood to the heart.
- Give the physiological basis for arterial pulse and describe how the pulse is measured.
- Describe the factors which create and control blood pressure.
- Define blood pressure and give its relationship to blood flow and resistance.
- Explain and demonstrate how blood pressure is measured.
- Contrast the pulmonary and systemic circuits of the cardiovascular system.
- Trace a drop of blood through the pulmonary and systemic circulations.
- List and describe diseases/disorders associated with the cardiovascular system.
- Define and describe the functions of the lymphatic system.
- Explain how the lymphatic system is functionally related to the cardiovascular and lymphatic systems.
- Describe the location of the major lymphatic pathways.
- Describe the formation and composition of lymph and explain how it is transported through the lymphatic system.
- Describe a lymph node and its major functions.
- Locate the major chains of lymph nodes.
- Describe the functions of the thymus and the spleen.
- Explain the differences between specific and nonspecific body defenses and provide examples of each defense.
- Define immunity and describe how T and B cells arise.
- Explain the relationship between an antigen and an antibody.
- Explain how allergic reactions and tissue rejection reactions are related to immune mechanisms.
- List and describe disease/disorders associated with the lymphatic system.
- Define important terminology of the lymphatic system.e important terminology of the cardiovascular system.

UNIT 4: Urinary System & Fluid, Electrolyte, Acid Balance

Summary and Rationale	
<p>Cells produce a variety of wastes which if they accumulate will become toxic to the body. Body fluids such as blood and lymph carry wastes from the tissues that produce them and transport them to the outside. The urinary system removes certain salts and nitrogenous wastes and it also maintains normal concentrations of water and electrolytes within body fluids and helps control red blood cell production and blood pressure. Cell functions and survival depend on homeostasis. In such an environment body cells continually receive oxygen, nutrients and wastes are continually carried away. At the same time, the water and dissolved electrolyte concentration and the pH of body fluids remain constant. Homeostasis requires water, electrolytes and acid-base balance.</p>	
Recommended Pacing	
13 days	
State Standards	
<p>HS-LS1-1. Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life.</p>	
Assessment Boundary	Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.
<p>HS-LS1-2 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.</p>	
Clarification Statement	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
Assessment Boundary	Assessment does not include interactions and functions at the molecular or chemical reaction level.
<p>HS-LS1-3 Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.</p>	
Clarification Statement	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
Assessment Boundary	Assessment does not include the cellular processes involved in the feedback mechanism.
Instructional Focus	
Unit Enduring Understandings (Cross Cutting Concepts)	
<ul style="list-style-type: none"> ● Scientific investigation requires selection of suitable technology and use of appropriate methods based on intended purpose to collect, analyze, and interpret data to test prediction/hypotheses and diagnose disease. ● Organisms are composed of complex biochemical systems that are designed to maintain homeostasis. ● Survival of organisms is dependent on the relationship between structure and function. 	
Unit Essential Questions	
<ul style="list-style-type: none"> ● How do the components of the urinary system work together? ● What disease, condition, or disorder can occur if the urinary system is not working properly? ● How is fluid, electrolyte, and acid balance maintained in the body? 	
Objectives	
Students will know & be able to:	
<ul style="list-style-type: none"> ● List the structures and organs of the urinary system and describe their general functions. 	

- Describe the location and the structure of the kidneys.
- Describe the pathway of blood through the major vessels within a kidney.
- Explain how a nephron works and describe how the major parts function.
- Describe the production of glomerular filtrate and its composition.,
- Describe the factors which affect the rate of glomerular filtration and how it is regulated.
- Describe the role that tubular reabsorption plays in urine formation.
- Describe the structure of the ureters, urinary bladder, and urethra.
- List and describe diseases/disorders associated with the urinary system.
- Define important terminology of the urinary system.
- Describe the various fluid compartments of the body.
- Explain what is meant by water and electrolyte balance and discuss the importance of this balance.
- Explain how electrolytes enter and leave the body and how the input and output of electrolytes are regulated.
- Explain what is meant by acid/base balance.
- Explain the functions of sodium, chloride, potassium, calcium, phosphate, and magnesium and regulation of their concentrations.
- List the major sources of hydrogen used in the body.
- Compare the role of buffers, exhalation of carbon dioxide, and kidney excretion of H⁺ in maintaining pH of body fluids.
- List and describe disease/disorders associated with fluid, acid/base and electrolyte balance.
- Define important terminology related to fluid, electrolyte, and acid/base homeostasis.

UNIT 5: Male & Female Reproductive System

Summary and Rationale	
<p>Most organ systems function almost continuously to maintain the wellbeing of the individual. The reproductive system however appears to “slumber” until puberty. The primary sex organs, or gonads are the testes in males. The gonads produce sex cells called gametes and secrete a variety of steroid hormones. The remaining reproductive structures i.e. Ducts, glands and external genitalia are the accessory reproductive organs. Most organ systems function almost continuously to maintain the wellbeing of the individual. The reproductive system however appears to “slumber” until puberty. The primary sex organs, or gonads are the testes in males. The gonads produce sex cells called gametes and secrete a variety steroid hormones. The remaining reproductive structures ie. Ducts, glands and external genitalia are the accessory reproductive organs. The reproductive role of the female is far more complex than that of the male. Not only must she produce gametes but her body must prepare to nurture a developing fetus for approximately nine months.</p>	
Recommended Pacing	
13 days	
State Standards	
<p>HS-LS1-1. Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life.</p>	
Assessment Boundary	Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.
<p>HS-LS1-2 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.</p>	
Clarification Statement	Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.
Assessment Boundary	Assessment does not include interactions and functions at the molecular or chemical reaction level.
<p>HS-LS1-3 Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.</p>	
Clarification Statement	Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.
Assessment Boundary	Assessment does not include the cellular processes involved in the feedback mechanism.
<p>HS-LS1-4. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.</p>	
Assessment Boundary	Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.
<p>HS-LS3-1. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins that carry out most of the work of cells.</p>	
Assessment Boundary	Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.
<p>HS-LS3-2. Inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.</p>	
Clarification Statement	Emphasis is on using data to support arguments for the way variation occurs.

Assessment Boundary	Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.
Instructional Focus	
Unit Enduring Understandings (Cross Cutting Concepts)	
<ul style="list-style-type: none"> ● Scientific investigation requires selection of suitable technology and use of appropriate methods based on intended purpose to collect, analyze, and interpret data to test prediction/hypotheses and diagnose disease. ● Organisms are composed of complex biochemical systems that are designed to maintain homeostasis. ● Survival of organisms is dependent on the relationship between structure and function. 	
Unit Essential Questions	
<ul style="list-style-type: none"> ● How do the components of the reproductive system work together? ● What disease, condition, or disorder can occur if the reproductive system is not working properly? 	
Objectives	
<p>Students will know & be able to:</p> <ul style="list-style-type: none"> ● State the function of the male reproductive system. ● List the parts of the male reproductive system and describe the function of each part. ● Name the endocrine and exocrine products of the testes. ● Discuss the importance of semen and name the glands that produce it. ● Describe the structure of sperm and relate the structure to its function. ● Trace the pathway followed by sperm from the testes to the exterior of the body. ● Explain the symptoms and causes of sexually transmitted diseases. ● List and describe diseases/disorders associated with the male reproductive system. ● Define important terminology related to the male reproductive system. ● State the functions of the female reproductive system. ● List the parts of the female reproductive system and describe the functions of each part. ● Describe the structure of the ovary and how egg cells and follicles are formed. ● Describe the role that hormones play in control of the female reproductive system and in the development of secondary sexual characteristics. ● List the major events that occur during the menstrual cycle. ● Describe the process of fertilization and identify the time of the menstrual cycle at which sexual intercourse is most likely to result in pregnancy. ● Describe the major events of pregnancy. ● Describe the functions of the amnion and placenta. ● Describe the stages of birth and the role that hormones play in this process. ● Describe the structure and function of mammary glands. ● Identify several methods of birth control and evaluate the effectiveness of each method. ● Explain the symptoms and causes of sexually transmitted diseases. ● List and describe diseases/disorders associated with the female reproductive system. ● Define important terminology of the female reproductive system. 	